Rural Lines

RURAL ELECTRIFICATION ADMINISTRATION • U. S. DEPARTMENT OF AGRICULTURE

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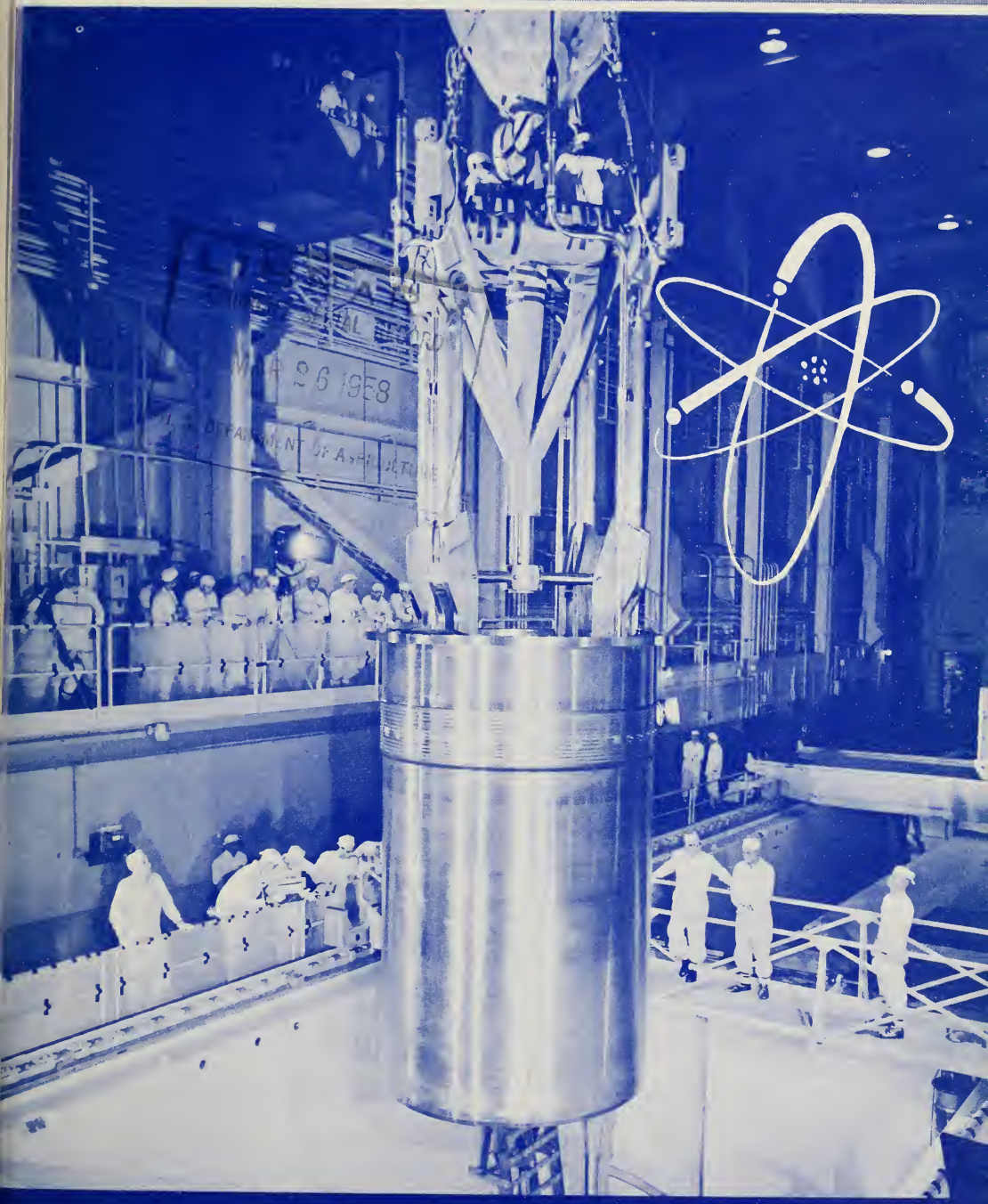

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Profile of the Future see page 3

A Message from the

ADMINISTRATOR

I am going to use this "message" to appeal for cooperation—cooperation between rural electric and rural telephone systems in getting telephones farther out into rural areas.

On a number of occasions in recent months managers and directors of both telephone cooperatives and independent telephone companies have told me of difficulties they have encountered in working out joint arrangements for use of poles. Some electric systems, they say, are reluctant to enter into such agreements.

Joint use of poles is one way of holding down costs of telephone service. For some rural people it might well mean the difference between getting service or going without it.

I call this to the attention of electric system directors and managers because I know they are anxious to fulfill their community responsibilities, and helping rural people get telephone service comes under that heading.

I urge all borrowers to pitch in and to arrange for joint use of poles where it is practicable. REA will give every assistance in working out those arrangements.

Administrator.

David A. Hamil

Rural Lines

THIS MONTH'S COVER

Wearing the white safety overalls that are a badge of their trade, atomic technicians of Westinghouse Electric Corp. and the Duquesne Light Co. slowly lower the glistening, multimillion dollar nuclear fuel charge into its steel container at the Shippingport, Pa., generating plant. A pilot project today, there may be many nuclear power plants around the Nation by 1985.

Editor: Hubert Kelley, Jr. This month's contributors: Louisan Mamer, Battelle Memorial Institute.

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More Changes In Farm Technology

ATOMS, ELECTRONICS and PEOPLE

A 20th Century farmer has lived through more change in his lifetime than have half a dozen generations of farmers in centuries past. Within just a few decades, he traded his horse for a 250 horsepower auto engine, his mule for a tractor, and his kerosene for kilowatts.

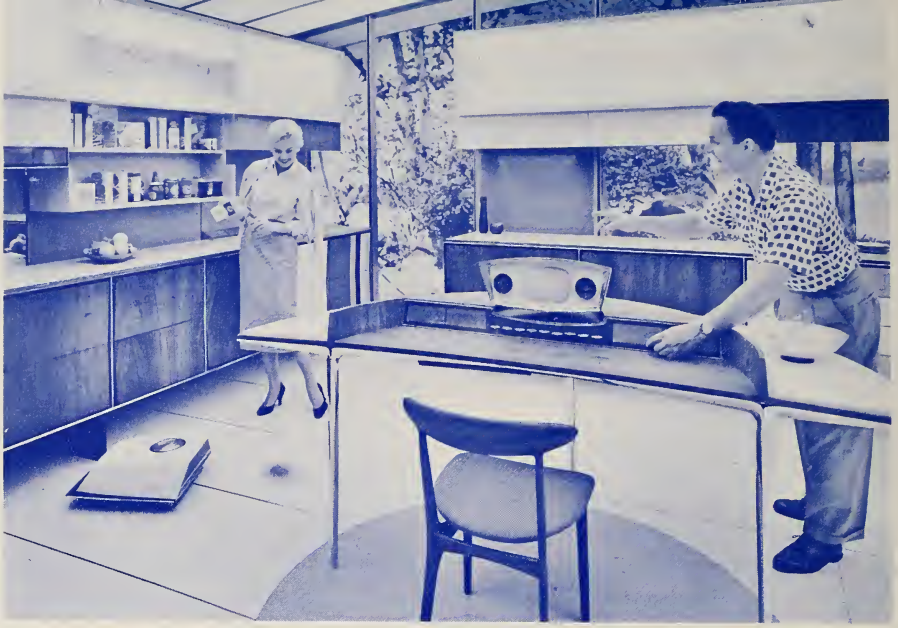
Today the rate of change is accelerating, not slowing. Yesterday the farmer had to learn how to mechanize his operations. Tomorrow, he will have to learn to live with atoms, electronics, and several million more people.

In the long run, America's expanding population will make it an economic necessity to increase farm yields per acre. Experts say that there will be about 250 million people in the United States in 25 years. There will be 25 million more families than there are today, and a big share of them will set up housekeeping in rural areas. Highways, non-farm housing, and industrial developments will continue to eat up vast areas of farm land each year. Nevertheless, forecasters predict that the farms that are left will produce one-third more food and fibre than farms do today.

This is a challenging future, and this issue of RURAL LINES offers a look at some of the inventions in electricity, atomic physics, and telephony which will help shape that future. This is not science-fiction; it is a telescopic view of some of the things already coming down the road toward us.

Tomorrow's electrification adviser will have a brand new professional vocabulary, including such terms as *electroluminescense, ultrasonic, self-propelled,* and *magnetron.*

The future home may contain no lamps, no lighting fixtures. In-



New ideas put to work in RCA Whirlpool Miracle Kitchen include a mobile floor cleaner operated from control center in foreground. It darts out at left to scrub spot from floor. It returns to port to replenish water and cleansing agent.

stead, there will be glowing panels of light (called electroluminescent by scientists) which will contain no bulbs or tubes. Substances which glow brightly when excited by an electric current are sandwiched between thin sheets of glass. A change in voltage brightens or dims the panels; a change in frequency alters the color of the light from white to blue, green, or rose.

So far, electroluminescent installations are prohibitively expensive, but so were the first laboratory models of light bulbs. Some day soft, shadowless panel lights may be common in workshop and farm buildings, as well as in homes.

Silent Refrigeration

Another family of substances, called thermo-electric materials, produce either heat or refrigeration when a current is passed through them. Utilizing this recent discovery, researchers have built an electronic refrigerator which is operating well in the laboratory. It is noiseless, since it has no compressor, motor or other moving parts. An experimental heating and air conditioning unit uses a direct current to produce cold; when the current is reversed the unit produces heat. It is quiet and draftless.

Magnetrons for Cooking

Electronic ranges that cook in a flash, produce little or no heat, are on the market now. They cook with high frequency waves from a magnetron, the top-secret wartime invention that made radar tick.

Other new electrical inventions for the kitchen include a large bell-shaped hood which descends to cover a container of food, cooks it electronically. Already on the market are plug-in frying pan lids which literally burn up grease, smoke, and grime. The lids are called "catalytic," and the same principle has been ap-

Easy-to-reach freezer drawers in Miracle Kitchen glide out with a wave of housewife's hand.

Another wave of the hand, and a concealed drop-down wall refrigerator lowers to counter lever.

plied to produce ductless range hoods.

Ultrasonic, or high frequency, sound waves are used now by food processors and by industry. Someday they may find their way into homes to greatly increase the cleaning power of washing machines and dishwashers.

The photo-electric cell, which takes orders from either the sun or a shadow, is already busy on farms and in processing plants. More jobs turn up for this reliable electronic worker every year. Today cells turn on security lighting when the sun goes down; they throw the switch in turkey and chicken houses. They sort eggs or lemons by color. Modern cells are so sensitive that they can spot imperfections inside potatoes. They can operate automatic shutters in barns to shade cows from sun or in greenhouses to let the sun in.

Building Blocks of Future

These electronic and sonic inventions are basic building blocks

It isn't windows that make this Westinghouse room glow with light, but electroluminescent panels.

from which tomorrow's electrified farm may be constructed. Some applications suggested so far may seem frivolous or remote. But they are serious business to researchers. Tomorrow, imaginative farm youths may be able to apply them to farming in practical and important ways, just as their fathers put electric power to work on more than 400 jobs.

A LOOK AT THE FUTURE

Electricity + Agriculture

by Harold J. Behm and R. Glenn Fuller

THIS article is a condensation of one first published in the October 1957 *Battelle Technical Review*. The *Review* is the monthly magazine of the Battelle Memorial Institute, an endowed foundation engaged in scientific research in Columbus, Ohio. Mr. Behm, one of the authors, is an electrical engineer with a farming background. Mr. Fuller has been engaged in study of both agricultural and biological problems. *Rural Lines* is indebted to the Editors of the *Review* for permission to reprint this condensed version of Battelle's predictions.

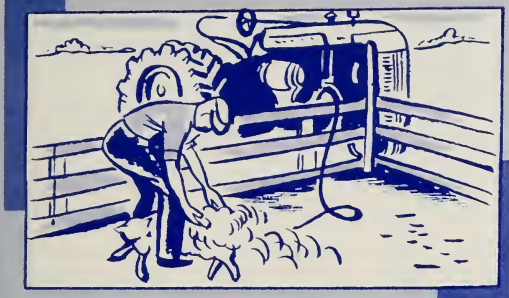
THE use of electricity on the farm is in a period of transition. The first half of the 20th century has seen central-station electricity brought to more than 93 percent of U. S. farms. The second half of the 20th century will undoubtedly witness wide scale application of this new farm servant to reducing farm drudgery and increasing production per farm worker.

Something of what may be in store for agriculture can be gathered from electrical and electronic developments that have brought momentous changes in manufacturing. Currently, the average worker in manufacturing industries uses approximately 20,000 kwh annually to aid him in producing goods. This contrasts with the 2,500 kwh used by the average farm worker. The difference is likely to be reduced considerably by the year 2000 as farmers turn more toward electric power to aid them in increasing the efficiency of their operations.

From recent trends, it is clear that by the end of this century our population could conceivably almost double. But even a smaller growth would greatly increase the need for farm products. Moreover, there is a growing demand for agricultural products for industrial processing.

Yet, in the face of this rising need, both our farm population and available land are shrinking. At the same time, the loss of land to suburban development is accelerating. It is estimated that such losses may reach 15 million acres in the next 25 years.

Obviously, this situation calls



for an increasingly efficient system of agriculture. On the basis of our new experience in the field of manufacturing, the new equipment and techniques required to meet the needs will depend heavily on electric power.

One of the factors that may slow the widening use of electricity is the form in which it is made available. Most farms today have only single-phase power. Only relatively large farm units have three-phase power. Really large-scale use of this form of energy will require perhaps 440 volts, three-phase, as is now utilized in most industrial plants. Thus the problem of distributing adequate central-station power to farms is not yet completely solved.

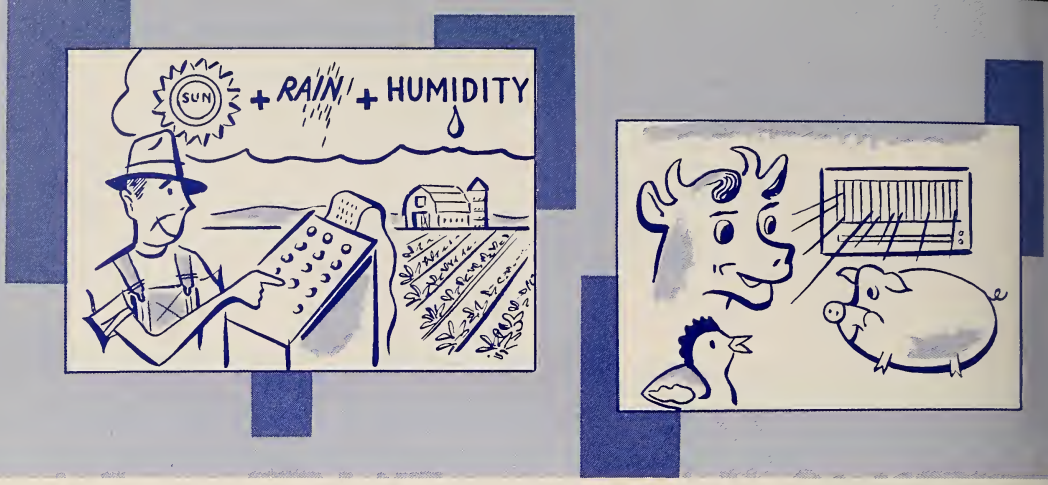
Room for Improvement

Electricity is still primarily the servant of the industrial worker. Lighting and domestic uses of current are found on all electrified farms, but many types of electrical equipment are in use on only a few farms, as shown on page 10. Even in the instance of lighting, there is much room for improvement. On most farms, the consumption of electricity for lighting alone could be profitably increased 2 or 3 times to provide a more efficient, safer, and more pleasant environment for after-dark operation. Particularly in farm areas near cities, there is need for security lighting around the buildings and high value crops.

More Automation Needed

In both the poultry and dairy industries, it has been the larger producers who have made most extensive use of electrically operated equipment. Thus, it is estimated that, on the average, 53 man hours are still required to produce $100 worth of milk. If the available supply of labor continues to shrink and its cost continues to go up, producers, particularly the smaller ones, will be forced to employ more electric energy to do their work if they are to remain in business.

One of the major problems in farm operations is that of materials handling. Estimates indicate that the materials handled on the farms in the United States approach a billion tons annually. It is probable that much of the advancement in the future will be with the assistance of electri-



cally powered conveyors, blowers, trucks, pumps, and other devices to reduce hand labor in the handling of farm products, needed materials, and farm wastes.

Smaller Motors Coming

Most farm machines operate from a single power source with belts to drive various components. As equipment becomes more complex, the use of several smaller motors is likely to become desirable. Such individual electric drives permit the machine to function more efficiently. Mobile generators would make practicable the use of such electrically driven equipment in the field and permit operations not otherwise possible. For example, field repair of machinery is facilitated by the use of welders, drills, and other electrically powered tools. Tractor-mounted, electrically-powered insect and weed-killing devices may also be possibilities.

The latter part of the next half century will see application of many things not even under consideration at the present time. Nearly 40 years ago workers in the U. S. Department of Agriculture discovered that the development of certain plants, particularly their flowering, was regulated by the amount of daylight during the growing period. In practice, regulation of flowering by control of the photoperiod has been almost entirely confined to glasshouse crops. Recently, however, it has been shown that subjecting plants to a single short flash of light during the dark period may be as effective in securing the photoperiod response as continuous light of several hours duration. This finding brings us a step nearer the possibility of regulating the flowering of farm crops by the use of artificial light. Where short exposure is sufficient, high-intensity lights mounted on a tractor might provide adequate exposure.

Farming Tricks With Light

Stem elongation, stem bending in response to light, seed germination, and other growth phenomena are affected differently by different wavelengths of light. The use of electric lights of a specific wavelength to regulate or stimulate specific plant processes is still only a research method—though a highly successful one—for exploring the mysteries of plant growth. But the next 50

years may very well see the method put to work in practical agriculture.

Other studies have been made of the effect of radio-frequency energy, infrared energy, X-rays, thermoneutrons, cathode rays, gamma rays, and dielectric heating. These studies, in most cases, have been related to controlling insects or fungus growth in seeds and seed-handling equipment, and insects in harvested grain.

Radiation for Orchards

Perhaps one day in the future, the smudge pots used to keep fruit blossoms from freezing in the spring may give way to a high-frequency system in which the blossoms will be heated by electromagnetic radiation which envelops the orchard.

The replacement of tractors by electrical power will probably become more feasible as the agricultural process becomes more concentrated, as higher production per unit of land is required, and with the possible added incentive of higher fuel costs for piston engines.

In the future, it is expected that more use will be made of program - type control on the farm. Such a system might find application in the poultry house by periodically operating a conveyor belt to fill feed hoppers, another to move eggs to the storage room, and another belt to move droppings to a collection bin. It may well be possible to provide nearly an automatic poultry plant in which one operator can care for a large number of birds.

To attain the farm production necessary to feed a rapidly increasing population will require that electricity not only take over labor-saving tasks, but assist the farmer in the management of his operation as well. For example, many operations could well afford to utilize data-taking units for reporting such information as the amount of sunshine ar artificial radiation, the amount of moisture (natural or artificial), the air temperature, relative humidity, and data on other pertinent factors affecting crops.

Harvest Date from Computers

These could be fed into a computer along with information about such controllable variables as types or amounts of fertilizers applied and applications of weed and insect control chemicals.

Item	Percent of Electrified Farms Using Electrically Powered Equipment
Light	100
Milking machines	80
Water systems	60
Milk cooler	50
TV sets	40
Milk house heaters	20
Chick brooders	20
Barn cleaners	10
Silo unloaders	5
Pig brooders	2½

Fig. 1. Use of Electrical Equipment on Farms

After processing the data, it should be possible to predict the date for the ripening of the crop, determine the steps required to bring a crop to maturity at a desired date, and to estimate closely the volume of the harvest.

The utilization of mobile-power, materials-handling, livestock-servicing, and other types of equipment is already changing the agricultural picture on many scattered farms. The mere expansion of the use of such available equipment will add considerably to our productive capacity. But the development and adoption of many techniques now in the experimental stage—such as methods for the control of the environment, equipment for program-type control of various operations, and computers — will bring a virtual electrical revolution in our system of agriculture.

When Do Families Replace Equipment?

Agricultural Research reports that families in this country buying new electric and gas ranges use them for an average of 15 years before replacing them. Electric washing machines, both the automatic and the wringer and spin-dryer types, are being replaced after 9 years, if they were new when acquired. Items bought secondhand are kept in service about half as long as new ones.

These facts were revealed by a recent USDA survey, which showed that rural families tend to use their electric refrigerators and manual washing machines longer than city families. Investigators believe this is due largely to lower income levels in rural areas. They also believe that farm families have tended to hang on to wringer and spin-dryer washers longer because the water supply on many farms is inadequate for automatic washing machines.

On the other hand, findings show both gas and electric ranges have shorter life expectancies in rural than in urban areas. Investigators note that ranges get harder use in rural households, since families are larger and more food, especially baked goods, is prepared at home.

INTERVIEW with REA's ATOM EXPERT

Wade M. Edmunds, REA's Special Assistant for Nuclear Power Projects, answers questions about peacetime uses of atomic energy. An engineer, Mr. Edmunds prepared for his present job at AEC's Argonne National Laboratory.

Q The world's first full-scale nuclear-electric generating plant designed only for the production of power reached full capacity last December at Shippingport, Pa. How is electricity generated there?

A In many ways, the plant at Shippingport resembles conventional steam generation plants. Heat makes steam, and the steam turns turbo-generators. The big difference is that the heat is taken from nuclear fuel instead of coal at Shippingport.

Q How powerful is nuclear fuel?

A A piece of Uranium 235—which is one type of fuel—about the size of a pinhead will produce about 6,000 kwh if it is completely fissioned—or enough electricity to supply one average rural consumer for a year.

Q In spite of its power, isn't Uranium still a lot more expensive to use than coal?

A Yes, in this country where coal is comparatively cheap, it is. Also, we haven't yet learned to utilize all the available heat from atomic fuel. And as fission takes place, poisons are formed which slow the reaction down and finally stop it. Then you have to remove the fuel and purify it. But don't forget—it seems inevitable that nuclear fuel costs will go down in future years, while conventional fuel costs will increase. We might even get to a point where the cost of nuclear fuel will be nothing.

Q Is that really a possibility? It sounds like perpetual motion.

A There is a chance of developing a breeder type of reactor in which as much new fuel is produced as is consumed. In the meantime, different types of reactors will be tried out to determine the most efficient way to use nuclear fuel for power generation.

Q Is the Shippingport plant the only one in operation in the United States right now?

A No. There are several, including a 5,000 kwh turbine plant

at AEC's Argonne National Laboratory. This one has been operating successfully for more than a year, and shows promise of cutting the costs of atomic power generation by a great deal. And there is a small plant at Fort Belvoir near Washington, D. C., which has operated without any difficulties since April 1957.

Q When can we expect more atomic plants?

A Several are under way now. An association of 12 New England utilities called the Yankee Atomic Electric Company will complete a 134,000 kw plant in Massachusetts in 1961. Two other plants are scheduled to be finished the same year in Michigan and Nebraska.

Q How about co-ops?

A The AEC has accepted proposals from three REA co-ops—Rural Cooperative Power Association, in Elk River, Minn.; Wolverine Electric Cooperative, Big Rapids, Mich., and Chugach Electric Association, Anchorage, Alaska.

Q What is the status of these?

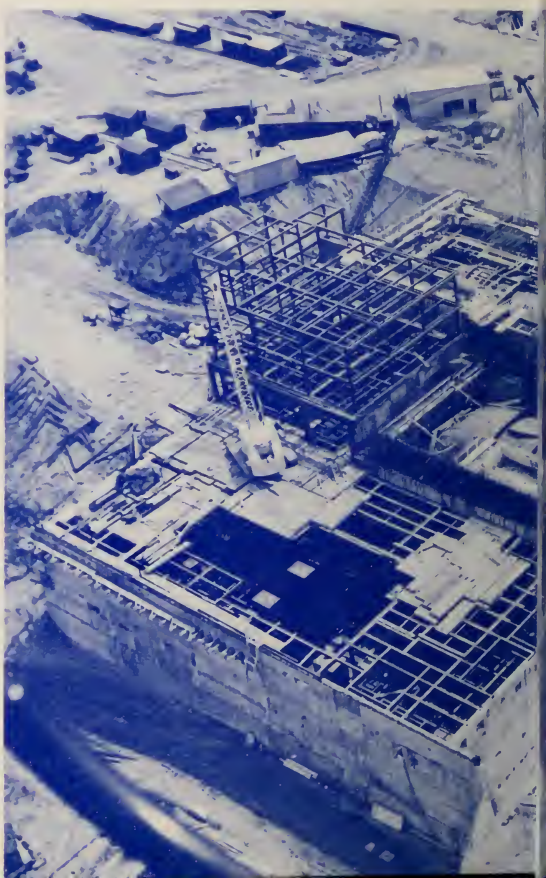
A Negotiations for contracts to construct reactors in Elk River and Big Rapids were suspended last September when the manufacturers involved increased their bid prices to figures which AEC couldn't accept. New proposals will be considered as soon as they are submitted. The Alaska reactor is still in the research stage.

Q Will REA make loans to co-ops for constructing reactor power plants?

A Under the Rural Electrification Act, REA can make loans which can definitely be shown to

With a wave of a radioactive wand in Denver in 1954, President Eisenhower started a shovel which broke ground for the Nation's first full-scale atomic-electric generating plant at Shippingport, Pennsylvania.

By 1956, contruction at Shippingport was w the huge cylinders to the left and right of t these is fed to a turbo-generator, which prod



derway. The reactor plant containers are ne at the top of the picture. Steam from ie electricity.

be feasible. At the present stage of development, a nuclear reactor is not as economical as a steam boiler — which it replaces — so REA can make loans only for the conventional portion of a reactor plant.

Q How were the three REA co-ops able to negotiate for nuclear reactors?

A At the time those negotiations were started, the AEC offered several kinds of assistance, including waiver of charges for use of nuclear fuel material for 5 years. AEC also agreed to perform research and development work in AEC laboratories at reduced costs, to purchase technical and economic information gained in the project, and to finance and retain title to the reactor portion of the plant.

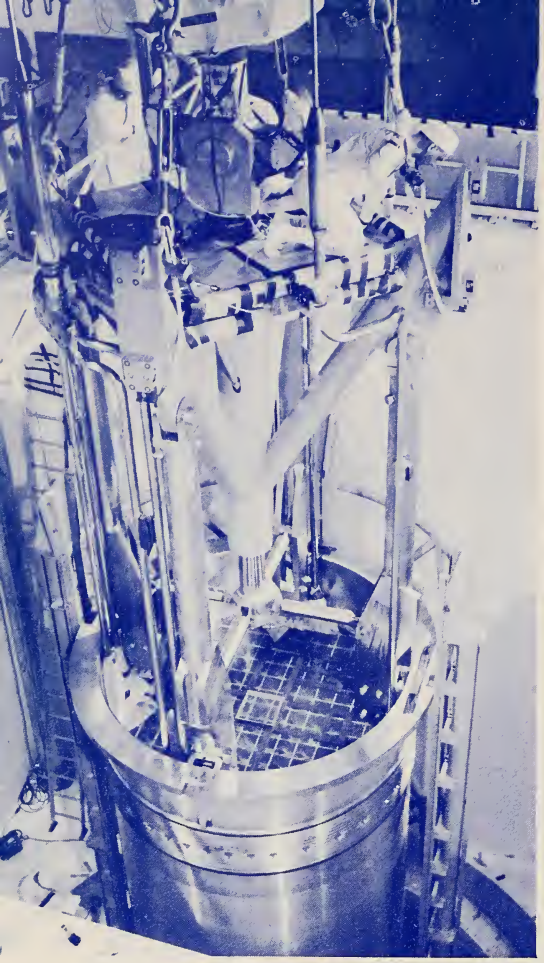
Q How soon do you think nuclear generating plants will be commonplace in the United States?

A The best guess is that we will have nuclear power plant capacity of over 200,000,000 kw by 1980. You will see a lot of plants go up before then, however.

Q What's the outlook for small generating plants?

A Reactor plants of 10,000 to 50,000 kw will ultimately become of great interest. Someday we may see small automatic power plants replacing substations for serving rural areas. This would eliminate large central generating plants and transmission lines.

Q With so many plants around the country, lots of people are going to be worried about the chance of explosions. Just how dangerous is an atomic power plant?



On Oct. 6, 1957, engineers at Shippingport began the painstaking work of lowering the 58-ton core, or nuclear fuel charge, into the pressure vessel. The job took many hours.

A Let's get one thing straight. Nothing resembling an atomic bomb explosion could occur in a nuclear power reactor. The concentration of materials is quite different from those in a bomb. The only similarity is that a process called nuclear fission takes place in both the bomb and a nuclear power plant. To compare them further is like comparing a lightning bolt to a hot plate.

Q Is nuclear fission the same thing as splitting an atom?

A Yes, but my term is more exact. We split only a part of the atom, called the nucleus.

Q How does that produce heat?

A When a neutron is absorbed by a uranium nucleus, the nucleus is split into two or more fragments. This process is called fission, and it releases a large amount of energy. In the act of fission, two to three neutrons are also released. These create more fissions in other uranium nuclei, setting up a chain reaction.

Q Then what happens?

A This energy is released in the form of heat, which is carried off by a coolant. In many types of reactors, the coolant is water, and it is converted into steam.

Controlling a Reactor

Q How do you control the amount of heat from a reactor?

A Fortunately, there are certain materials—like cadmium and boron—which absorb free neutrons like a sponge. Since it is the neutron bullets which keep a chain reaction going, you can slow down the reaction or stop it by taking neutrons out of circulation.

Q Is that what they do at Shippingport?

A Yes, and at all the other atomic power plants. First, the nuclear fuel is mixed with a moderator which slows down the neutrons to a speed at which they are more efficient in sustaining the chain reaction. In addition, there are control rods made out of cadmium or other suitable material which can be lowered into the fuel mixture. When all the rods are fully inserted, the reaction stops. These rods make it possi-

ble to turn the heat on and off or raise and lower it with great precision. That's more than you can do with burning coal.

Q Doesn't the reaction ever get out of hand?

A The reaction doesn't always proceed at the same rate. If it is going too fast, however, you simply shove in a control rod, and it slows down.

Q It sounds as if the men who run the plants would have to be on their toes.

A They would, if control depended on men. However, electronic and mechanical devices are built into the reactor system so that controls are automatic. Operation of the reactor is almost entirely free of dependence on human judgment.

Q Is there any danger from an atomic plant at all?

A The chief concern of AEC has been in protecting people who work in plants from radiation. You have to take safeguards when you handle the waste materials from reactors. In view of the construction and the safety mechanisms built into reactors and the careful training of personnel, I would say that the risk of contamination is extremely low.

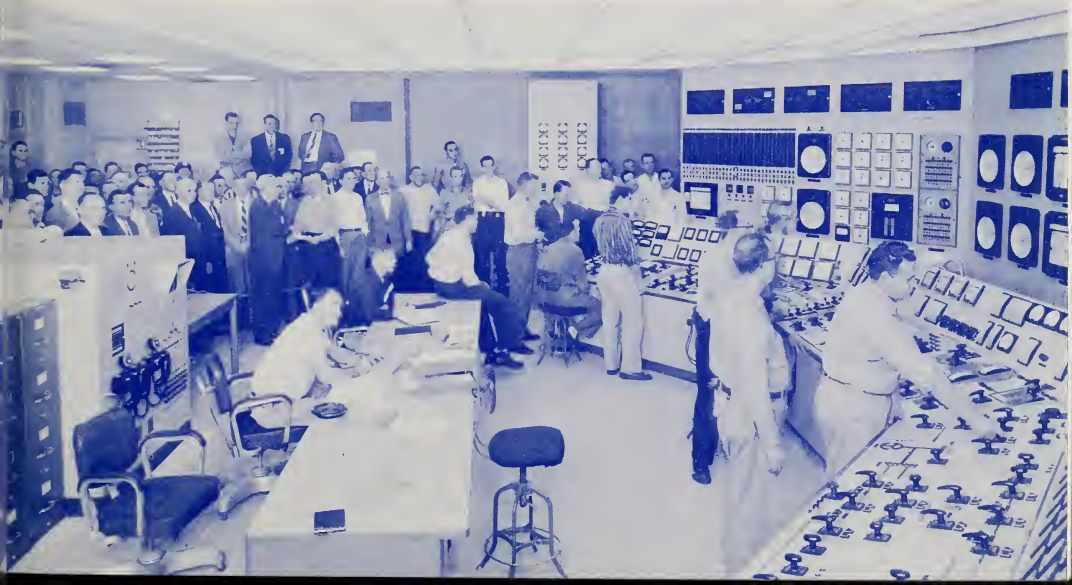
Insuring a Plant

Q Can you get insurance for an atomic plant?

A You can. It is essential for the operator of a reactor generating plant to have public liability and property damage insurance. Groups of commercial insurance firms have estimated they can provide coverage up to a total of $60,000,000 per reactor. AEC has issued temporary regulations requiring minimum coverage of $150,000 per 1,000 thermal kw. In addition, Congress has provided $500,000,000 maximum indemnity coverage.

Q How much would this insurance cost?

On Dec. 18, 1957, electric power was generated for the first time at Shippingport. Present were representatives of AEC and Duquesne Light Co., co-builders of the plant, and Westinghouse Electric Corp., which designed the nuclear reactor.



A The estimated annual premium for insurance to cover a 20,000 kw reactor plant would run about $40,000.

Q I understand there are experiments under way to find other uses for atomic radiation. Do any of these look promising for agriculture?

A Yes, they do. It looks as if atomic energy may be used to help farmers in three ways. First, it may help reduce losses in production, storage, and distribution. Second, it may help raise the productivity of the land. Finally, it can help develop new areas and resources.

Q What about using atomic energy as a food preservative?

A That's one of the most promising studies going on now. You see, atomic radiation can destroy the micro-organisms and insects which cause much food spoilage. And radiation can be done "cold." It doesn't lead to much increase in the temperature of the foodstuff during treatment, as canning does. It opens up the possibility of a wider distribution of perishable foods in the fresh state.

Q How long will irradiated foods keep without spoiling?

A With proper packaging to prevent recontamination, radiation can extend the storage life of some foodstuffs very considerably. You can package the stuff in plastic in advance, and irradiate the food right through it. The method is well adapted to the trend toward automation in the food industry.

Q Will irradiation keep any food fresh?

A Not all of them. It will stop bacterial spoilage, but some foods decompose because of action by enzymes or purely chemical changes. Radiation doesn't provide all the answers.

By-product of Generation

Q Isn't irradiation pretty expensive?

A It could turn out to be pretty cheap. It has been suggested that the radioactive by-products from nuclear reactors might be used for this purpose. Food preservation then could be a by-product of electric power generation.

Q What are some other uses for radiation?

A These are still in the research stage, but they could lead somewhere. Radioactive tracers are being used to discover how insecticides exert their toxic effects and also to determine what nutrients are essential in plant growth. It may be possible to control insects by sterilizing them with radiation, and experiments are going on to see how much radiation will speed up seed germination.

Q Do you expect more developments in the future?

A Oh, yes. Remember, the atomic age is only about 12½ years old. We have just taken the first step or two down a path that may be many years long.

Rural Lines

"Picture-phone"
invention to shape tomorrow
see page 18

From Telephone Labs to Farm and Home

INVENTIONS TO SHAPE TOMORROW

NEW ideas take hold slowly. As a rule, anywhere from 5 to 25 years elapse between the first appearance of an invention and its widespread use by Americans.

For example, the first public demonstration of television was held in 1927. Yet it remained an electronic curiosity for more than two decades, and it was 1951 before coast-to-coast TV became a reality.

Sooner or later, however, a good invention hurdles all obstacles and finds its way from laboratory to home or office or factory. The surest way to foretell the future, therefore, is to take a look at the gadgets that are in the scientist's workshop right now. Someday, in one form or another, they will take their place in the American market.

There is no shortage of new ideas in the research labs of the telephone industry. Some of them are being tested for consumer reaction right now. Others cannot be used until technical or financing barriers come down. Still others are so revolutionary that we can only guess at their implications for telephony.

All sorts of experimental telephone sets are being tried on the public at present. For many years, the industry offered subscribers only one style of telephone—whether for home or business — in only one color — black. The first break with this conservative tradition came in the post-war years with the emergence of color sets. Consumers liked color, and it is here to stay.

Next, the industry began asking some searching questions about the style of sets. Executives grew acutely sensitive to customer tastes and perferences.

Harold Huntley, head of the Bell System's recently created

Customer Products Planning Division, describes some of the questions with which his group is wrestling:

"Let's begin with this basic question, 'What is needed for a telephone?' You'd want to talk into it, listen, tell the operator of the machine you want to make a call and tell it you are through.

"Must all these things be in one box? There's no real reason why.

"About the dial: Do we want it on the handset and to come to us, or should it stay put. We don't know.

"Should people hold things in their hands, or should their hands be free? If tests indicate hands-free is the preference, that's the direction we'll take.

"With all this outdoor living, we may find that outdoor sets are desirable.

"Should we try using metallic color in instruments?"

There's no end to the questions, and Huntley and his staff, like men in other companies, are trying out all sorts of model phones on subscribers. Models being tested include a small version of the conventional set which will fit on a bedside table, phones in which pushbuttons replace dials, and phones built into desk drawers for executives who like clean tabletops.

Phones for Farmers

What do such phones have to do with farming? Industry officials feel sure that farm people, as well as city people, will have need for phones built to meet specific requirements. Some experimental phones, for example, have pre-set dials, permitting a subscriber to call his veterinarian, implement dealer, or feed supplier by dialing one number.

General Telephone Laboratories predicts that the loudspeaking, or hands-free, telephone will be the rule rather than the exception in the future. A speaker in the barn might enable a dairy farmer to keep right on conversing with the vet, while he carries out emergency instructions in caring for a sick cow. He could receive messages and reply to them without interrupting his chores.

Intercom Built into Homes

Many feel that the day is not off when most housing contractors will build a telephone intercommunication system into every new home or farmstead. Family members will then be able to communicate with each other by phone, as well as with outsiders, and a speaker on the front door or gate will permit identification of visitors. House-to-house peddlers won't have a chance to get a foot inside the front door.

Experiments are under way to provide public telephone booths that can be reached while the caller remains in his automobile. With these, the industry will follow the lead established by drive-in restaurants, theaters, banks, and the Post Office.

Even the familiar telephone bell, a direct descendant of ringers used 70 years ago, may be replaced. One promising substitute is called a tone ringer. It is really a horn with a small loud speaker attached to it. Consumer juries agree that the tone ringer delivers a more pleasant sound. Some say it is "less terrifying" than the conventional clapper bell. Another experimental unit

permits the subscriber to adjust it to deliver either a chime tone or a loud ring.

It's anybody's guess which sets will be in most demand in future years. But one thing seems certain. The era of a single style of phone in a single color is gone forever.

New Answering Machines

A variety of telephone answering devices are on the market today, and research labs are working on still more. A typical device answers the phone while you are out, plays a recorded message, and gives the caller several seconds to record his own message.

One new gadget enables the user of an answering machine to pick up his messages without bothering to return to his office. He simply dials his office, holds a device about the size of a cigarette package close to the telephone mouthpiece, and presses a button. The gadget emits a special tone which signals the answering machine to play back all messages recorded during the day.

A variation of the answering machine may be enthusiastically accepted by farmers as years go by. It is a warning device which can be set to respond to practically any change in its environment, such as noise level, temperature, pressure, or water level. When a situation arises that warrants an alert, like fire or flood, the silent sentry connects itself to a telephone dial, dials a pre-arranged number, and informs the person who answers of the trouble.

Inventions still in the laboratory include the TV-telephone. It is no longer science-fiction. A workable model was unveiled by Bell Labs nearly two years ago. Named the "picture-phone," it was the first system to transmit pictures along with sound over a pair of ordinary telephone wires. Recognizable pictures have been sent all the way from New York to Los Angeles.

If picture-phones were interconnected to the dial system, it would be possible to see a friend's picture as well as hear him. The person called could "stay out of the picture" by turning off his camera switch.

The picture-phone does not offer television quality. Television sends 30 pictures a second, giving a viewer the illusion of continuous motion. Since the picture-phone uses standard low-frequency telephone channels, it can send no more than one picture every two seconds. There is no "movie effect"; the result is more like a series of slides.

Long Distance Purchasing

Even with these limitations, however, businessmen and farmers might find a number of uses for such a phone. Purchases requiring selection from several styles could be made via long distance. Machinery parts could be identified by a dealer. The signature of a stranger could be verified by a call to his bank. A vet might make a preliminary diagnosis by phone. And for farm youngsters, the "blind date" would become an historical curiosity.

Obviously, an enormous physical task would confront the telephone industry if it attempted to interconnect picture-phones to the national dial network. Their

Telephone research teams try out one-of-a-kind set models on subscribers. If a model seems popular, it may get citywide or areawide tryout.

appearance, even in large cities, is still far in the future. In rural areas, picture-phones would have to follow private lines.

One of the most promising methods for giving privacy to rural subscribers involves "carrier." Carrier is used to send several messages over a single pair of wires at the same time. Arrangements of electric units send each message at a different carrier frequency, and electronic gear at the other end of the line sorts out messages as they arrive. In cables, two pairs of wire often are arranged to carry as many as 24 conversations simultaneously.

Presently, carrier provides most of the intercity telephone mileage, most of the telegraph mileage, and much of the intercity television program mileage. In addition, REA has pioneered in the application of the carrier principle to rural lines. It is used today to give private service to farm subscribers willing to pay the price.

So far, the special equipment needed in carrier systems pays for itself only on longer lines, where it saves a great deal of wire construction. As time goes by, it should pay for itself on shorter and shorter lines, since the cost of outside wire construction keeps going up faster than the cost of carrier channels. It will be a long time before private lines are the general rule, but the long range trend will be toward more and more carrier.

So far, carrier has depended on the relatively expensive vacuum tube for transmission and recep-

tion of messages. A miraculous post-war invention called the transistor may change all that. This tiny device will do most of the things that a vacuum tube will do. It requires very little power, takes up little space, and generates little or no heat. As scientists and production men find ways to produce the transistor more cheapy, it will replace the vacuum tube in a number of places.

REA is currently field testing a completely transistorized carrier system. Preliminary studies indicate that its cost will be one-half to one-third the cost of previous carrier systems based on vacuum tubes.

REA and the industry are finding ways to reach subscribers living in remote areas. Where terrain conditions do not favor wire line construction, microwave radio relay appears to be the answer. Such systems are being tried in parts of Louisiana, where swamps and corrosive salt vapor make lines impractical, and in a rugged section of Wisconsin.

Experiments also are under way to test the feasibility of replacing mechanical dial switches with electronic tubes. The metal contacts in present central offices might someday be replaced by small gas tubes. Signals would be routed through the tubes, and transistors and other new devices would do the brain work. A trial of this silent, fast switching system will begin next year in Morris, Ill.

Even more amazing, an electronic switching office could offer subscribers special number-remembering services. The phone numbers used most frequently by each subscriber could be filed on small photographic plates. In effect, the plates would "remember" the numbers. A caller could then reach his office simply by dialing "3" on his phone. Electronics would do the rest.

Telephone researchers also are working hard to perfect a hol-

Newest experimental telephones, including large planning area telephone with TV screen, are shown in action at Monsanto's House of the Future at Disneyland.

low copper tube called a "wave guide." The wave guide is used today in microwave radio applications, but its future may be much more exciting. Scientists believe that it may be possible to send as many as 400,000 telephone conversations at the same time through a pair of wave guides, applying the carrier principle.

Some day in the distant future, a national system of wave guide tubes might make it possible to transmit all sorts of information besides conversations. It might become economically feasible to transmit facsimiles of letters or legal documents or even daily newspapers directly to telephone subscribers at the speed of light. National sales managers could hold daily meetings with all their salesmen around the country. Farmers could receive detailed market information on private teletypes. The wave guide may provide broad superhighways for information among all people.

The most advanced research in the industry centers on a revolutionary theory of transmitting information. Its impact on telephony may be as great as the impact of Einstein's Theory of Relativity on physics.

Researchers in this new field believe that much of the information transmitted today is already known to the receiver. For example, the room in which a TV performer moves may be unchanged for several minutes. Yet the picture of the room is transmitted over and over again. Scientists are looking for ways to transmit only those portions of the picture which change.

If the theory can be applied to all kinds of communication, it may be possible to transmit intelligence over much narrower bands than are used at present.

This farmer is one of 54 out of every 100 who have phones today. The other 46 must be linked soon to the national communications network.

These new inventions—those in the notebook, in the model shop, and in the consumer research stage—will help shape the next 50 to 100 years of telephony. They emphasize the necessity for closing all the gaps in the national communication network. One of these days, the network may provide all sorts of information essential to the economic life of farmers and businessmen. The man who is not linked to the network may find himself out of touch with the world.

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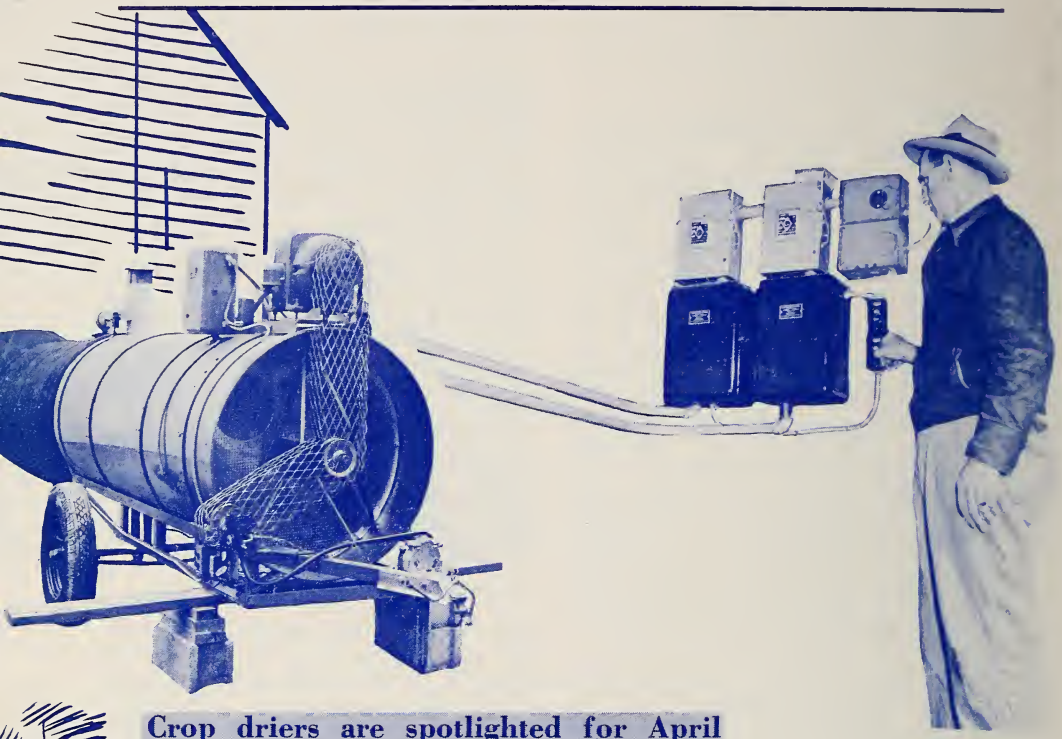

Crop driers are spotlighted for April promotion in the 1958 Power Use Calendar. This relative newcomer in electric farm equipment still has a low saturation among the farmers who can use it.